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Energy Security: A Global Challenge

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By
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Summary of Cyber Security Issues in the Electric Power Sector

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Energy Grid Security Panel

Energy Security: A Global Challenge

Symposium hosted by National Defense University

September 30, 2009

Outline

- ▶ Setting the context for challenges associated with control system security in the electricity sector
- ▶ Government efforts to address critical infrastructure protection for the electricity sector
- ▶ An overview of the Department of Energy's (DOE) National SCADA Test Bed Program
- ▶ Smart Grid security considerations
- ▶ The path forward

What makes control system security unique?

Control Systems

- ▶ Top priority is reliability and safety, not security
- ▶ Breaches in security can have physical consequences
- ▶ Traditionally relied on implicit trust with isolated systems
- ▶ Vendors provide “turn key” systems with remote support access
- ▶ Default passwords are commonplace

Computer Security

- ▶ Traditional IT security tools may not work for control systems
- ▶ Enterprise networks are being connected to control systems
- ▶ Control system security issues may be overlooked because they are not managed by IT security



Trends Impacting Control System Security

▶ Open Protocols

- Open industry standard protocols are replacing vendor-specific proprietary communication protocols

▶ Common Operating Systems

- Standardized computational platforms increasingly used to support control system applications

▶ Interconnected to Other Systems

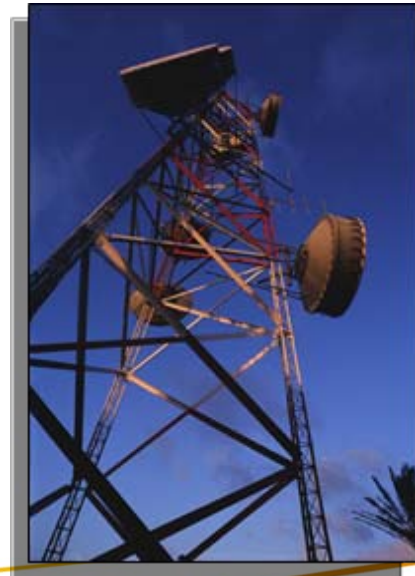
- Connections with enterprise networks to obtain productivity improvements and information sharing

▶ Reliance on External Communications

- Increasing use of public telecommunication systems, the Internet, and wireless for control system communications

▶ Increased Capability of Field Equipment

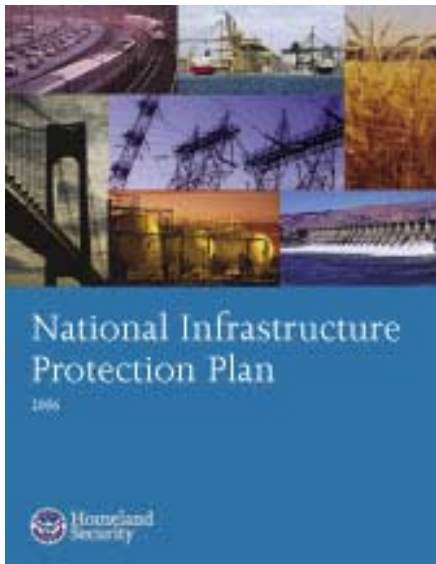
- “Smart” sensors and controls with enhanced capability and functionality



The Emerging Cyber Threat

- ▶ Industry has long history of planning for and coping with natural disasters and other reliability events
 - Through industry standard operating procedures, there is much effort expended to reduce likelihood of cascading outages leading to widespread blackouts
- ▶ Historically, cyber security focused on countering unstructured adversaries
 - e.g., individuals, untargeted malicious software, human error
- ▶ Very little protection against structured adversaries intent on exploiting vulnerabilities to maximize consequences
 - e.g., terrorist groups, organized crime, nation states
 - Insider threat remains very challenging, can be used as part of structured threat vector
- ▶ New possibilities for widespread sustained outages resulting from cyber attack are now being contemplated
 - But industry still not ready to cope with this threat

National Infrastructure Protection Plan (NIPP) Sector-Specific Plans (SSP)

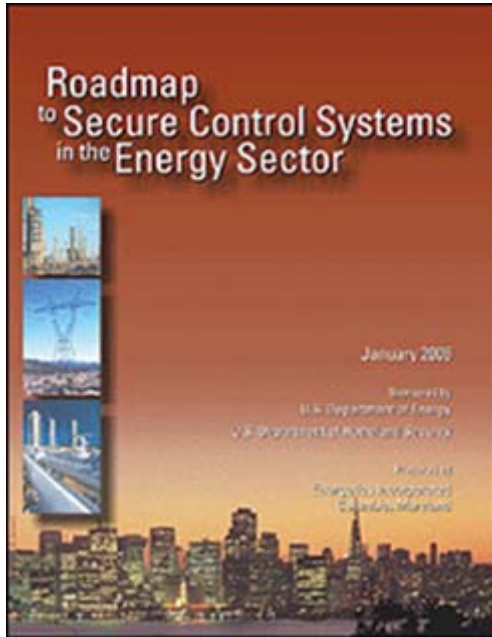


- ▶ Detail the application of the NIPP risk management framework across each sector
- ▶ Are tailored to address the unique characteristics and risk landscapes of each sector
- ▶ Sector-Specific Agencies (SSAs) partner with Sector Coordinating Councils (SCCs) and Government Coordinating Councils (GCCs) to develop and implement the SSPs for the overall NIPP



**Sector-Specific
Plans**

Roadmap – Framework for Public-Private Collaboration



- Published in January 2006
- *Energy Sector's* synthesis of critical control system security challenges, R&D needs, and implementation milestones
- Provides strategic framework to
 - align activities to sector needs
 - coordinate public and private programs
 - stimulate investments in control systems security

Available from:

<http://www.oe.energy.gov/controlsecurity.htm>

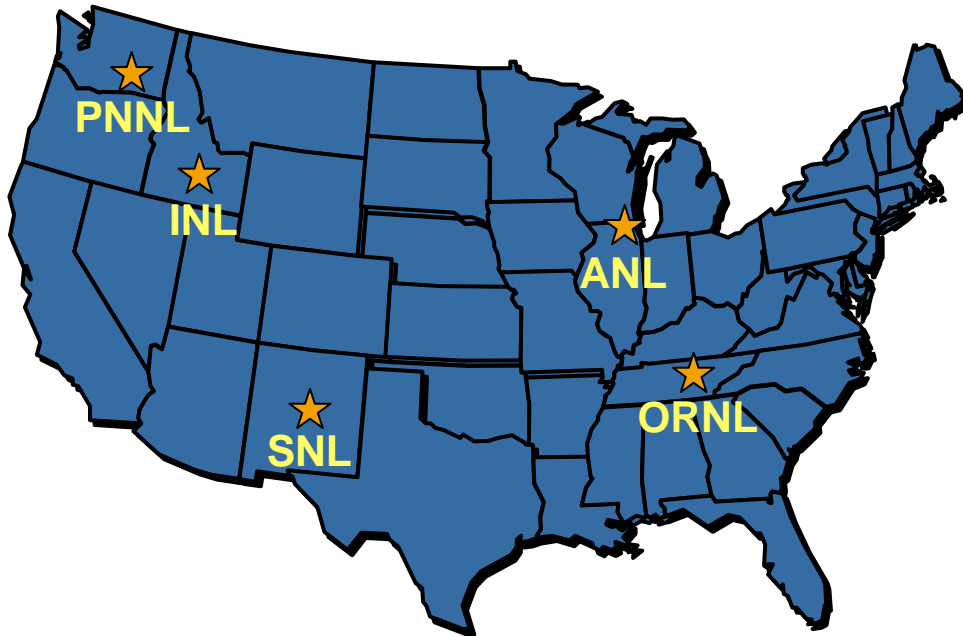
Roadmap Vision

In 10 years, control systems for critical applications will be designed, installed, operated, and maintained to **survive** an intentional cyber assault with no loss of critical function.

DOE National SCADA Test Bed (NSTB)

DOE multi-laboratory program ...established 2003

Supports industry and government efforts to enhance cyber security of control systems in energy sector



Key Program Elements

- Energy control systems vulnerability assessments and recommended mitigations
- Integrated risk analysis
- Secure next generation control systems technology R&D
- Public-private partnership, outreach, and awareness

Identifying Risks of Implementing Smart Grid Systems (an All Hazards Approach)

- ▶ Complexity
 - Introduces potential vulnerabilities
 - More access points (increased exposure)
 - Difficult to manage a complex system
- ▶ Power system would be more vulnerable to communication (or software) disruptions
 - Denial of service (e.g., unintentional load shedding)
 - Potential for common failure modes across connected systems
 - Software/system integrity (e.g., firmware, logic bomb, supply chain, etc.)
- ▶ Intelligence gathering tool for the adversary
- ▶ Potential for breach of customer privacy
- ▶ Implementation issues
 - Inappropriate or premature mandating of technologies that aren't appropriate for the application
 - Potential for technology obsolescence

Mitigating Smart Grid Implementation Risks

- ▶ Develop security controls
 - Policies, procedures, control baselines, reference architectures, conformance and interoperability testing, certification
- ▶ Need built-in (rather than bolt-on) security
- ▶ Apply good security practices
 - Follow best practices, established standards when available
- ▶ Apply defense-in-depth concepts
 - Redundancy, zones, proxies, role-based authority, etc.
- ▶ Instill a culture of security
 - Training, awareness, adequate resources, management support
- ▶ Develop transition strategy that maximizes interoperability, security, reliability, etc.
- ▶ Forensics and enforcement
- ▶ Establish trusted technology supply chain

Summary

- ▶ Cyber attacks can create service disruptions, and this trend is becoming more prevalent
- ▶ While recent industry-developed cyber security standards are a good start, more needs to be done to:
 - Reduce discretion
 - Eliminate loopholes
 - Provide more uniformity
- ▶ Much less staffing within industry than historic levels
 - Staffing shortfalls in certain disciplines becoming acute
- ▶ Information sharing not fully effective
 - Despite efforts to enhance public-private partnerships
 - Need meaningful vehicles for information exchange
- ▶ Fundamental need for new technologies with inherent security